

NEW RECORDS FOR CAPRELLIDAE IN CALIFORNIA, AND NOTES ON A MORPHOLOGICAL VARIANT OF *CAPRELLA VERRUCOSA* BOECK, 1871

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Abstract.—Recent collections of caprellid amphipods from Humboldt Bay, San Francisco Bay, and Elkhorn Slough (a small estuary associated with Monterey Bay), California have yielded specimens of *Caprella scaura*, new to North America, and *Caprella alaskana*, representing a southern range extension. Specimens of *Caprella mutica* were also collected, and *Caprella acanthogaster humboldtiensis* is treated herein as a junior synonym of *C. mutica*. Notes are included on an undescribed morphological variant of *Caprella verrucosa*.

The caprellidean amphipods of central California are incompletely known. Dougherty and Steinberg (1953) examined caprellids from the Dillon Beach area, Moss Beach, and the Pacific Grove-Monterey areas of central California, and more recently the caprellids of the American North Pacific have been studied by Laubitz (1970) and Martin (1977). Laubitz examined the fauna from the Gulf of Alaska to southern Oregon, and Martin covered the caprellids from the Oregon-California border to Fort Bragg, California. The composition of the whole central California region caprellid fauna has not been recently studied.

During 1978 and 1979 caprellids were collected from sites in Humboldt Bay, San Francisco Bay, and Monterey Bay, California. Specimens were obtained from the entrained cooling water of steam-electric power plants at Potrero and Hunter's Points in San Francisco Bay, and at the Moss Landing power plant in Elkhorn Slough, Moss Landing, California. Collections at power plants were made approximately once a week from March 1978 through March 1979. Some specimens were also collected during the spring of 1980 at the Humboldt Bay power plant, and a small amount of material was collected by hand from the floating docks at the Oyster Point yacht harbor, San Francisco Bay.

In these collections, I found one species of caprellid previously unknown from North America, *Caprella scaura*; a southern range extension for another species, *C. alaskana*; and an undescribed morphological variant of *C. verrucosa*. *C. mutica* was also collected during this study, and *C. acanthogaster humboldtiensis* is treated herein as a junior synonym of *C. mutica*.

Specimens of each species have been deposited in the National Museums of Canada, Museum of Natural Sciences, Ottawa.

Caprella mutica Schurin, 1935

Figs. 1C–F

Caprella mutica Schurin, 1935:198–199, Fig. 1; 1937:27–28, Figs. 7–8.—Utinomi, 1947:75.—Stschapora, Mokyevsky and Pasternak, 1957:87.—Vassilenko, 1967:208.—McCain and Steinberg, 1970:32.—Arimoto, 1971:18.—Vassilenko, 1974:201, Fig. 119.—Arimoto, 1976:111, Fig. 59.
Caprella acanthogaster humboldtiensis Martin, 1977:154, Fig. 3.
Caprella acanthogaster sensu Carlton, 1979:433.

Material examined.—Approximately 50 adult specimens from each of Humboldt and San Francisco Bays, and approximately 30 adult specimens from Elkhorn Slough.

Discussion.—*Caprella mutica* closely resembles *C. acanthogaster* Mayer, 1890. Both are characteristically heavily spined dorsally on pereonites 3 through 7, and in both species the male pereonites 1 and 2 are elongated. In addition, the gnathopods and ventral spination in these two species are similar. However, Vassilenko (1974) lists characters by which the males of these species may be distinguished. In *C. acanthogaster* (Fig. 1A) the cephalon, pereonite 1, and pereonite 2 are not setose; the cephalon and pereonite 1 each sometimes bear one pair of dorsal “spined teeth” or denticles; pereonite 2 always bears one or a few pairs of dorsal denticles; spines on the ventral edge of pereonites 3 and 4 do not form a border. For *C. mutica* (Fig. 1C) Vassilenko states: cephalon, pereonite 1, pereonite 2, and gnathopod 2 setose; cephalon, pereonite 1, and pereonite 2 smooth dorsally (i.e., denticles not present); spines on the ventral edge of pereonites 3 and 4 form a border.

I examined a 15.6 mm male specimen of *Caprella acanthogaster* from the Zoologisches Museum, Hamburg (Fig. 1B) (syntype ex K-21884b) which had listed as its locality Amur, China. This specimen had the following characteristics: cephalon, pereonite 1, and pereonite 2 not setose; cephalon and pereonite 1 smooth dorsally; pereonite 2 with 1 pair of small spines dorsally. The ventral spines on pereonites 3 and 4 did not give the impression of a border, but the ventral spines were more prominent than the dorsal spines found on pereonites 3 and 4. In addition, the gills of this specimen were long and slender. In the material examined from California, the males have the following characteristics: cephalon, pereonite 1, and pereonite 2, as well as gnathopod 2, setose, especially in larger specimens; cephalon and pereonite 1 smooth dorsally; pereonite 2 occasionally with 1 pair of small spines postero-dorsally in larger males. The ventral spines on pereonites 3 and 4 are less prominent than the dorsal spines on these pereonites, and the gills are oval, not long and slender (Fig. 1C). Some large (about 20 mm) paratype males of *C. acanthogaster humboldtiensis* Martin, 1977 were examined and have the following characteristics: cephalon, pereonites 1 and

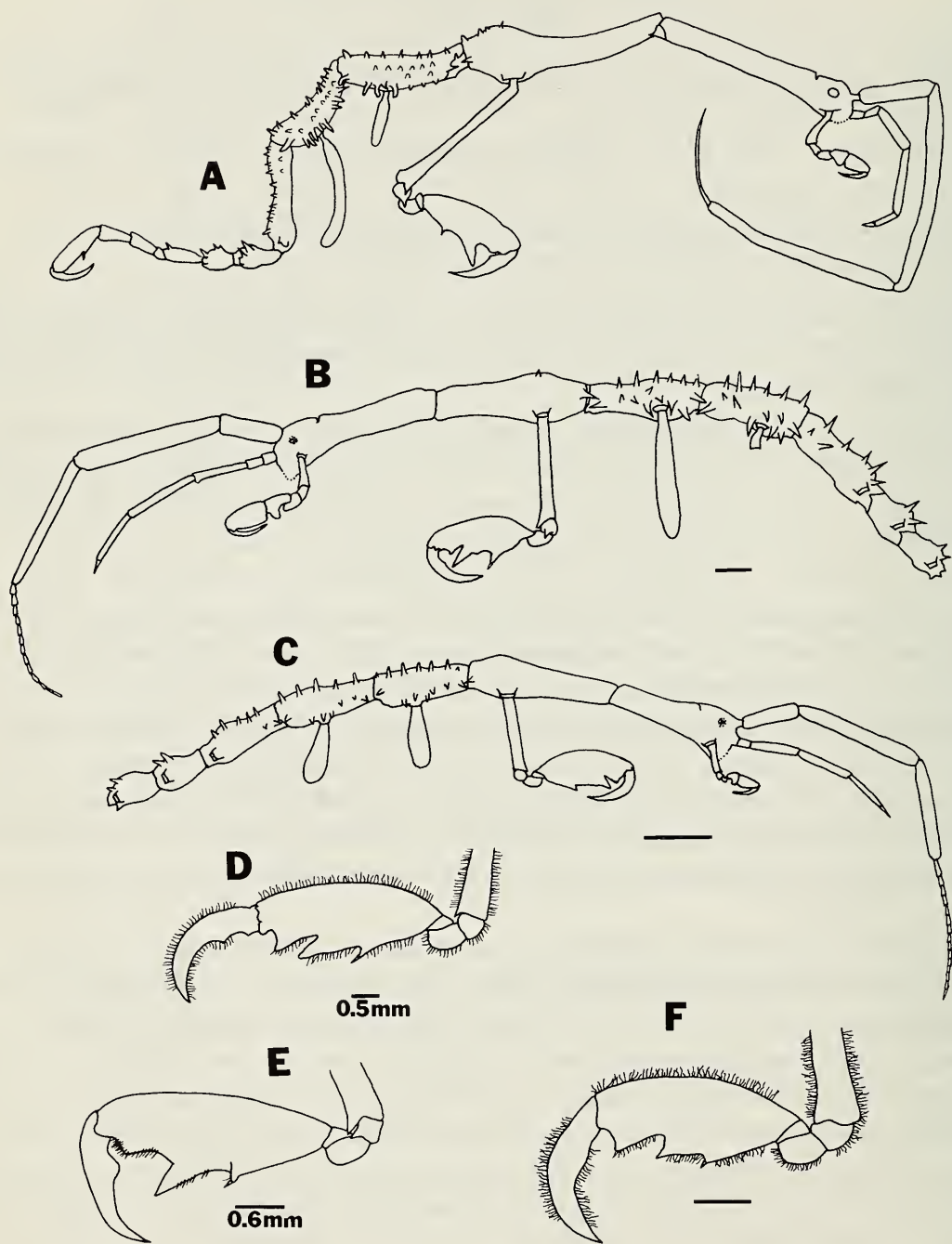


Fig. 1. A, *Caprella acanthogaster*, lateral view of male after Mayer, 1903; B, *C. acanthogaster*, lateral view of paratype from Hamburg Museum; C, *C. mutica*, lateral view of typical male collected from California; D, *C. mutica*, second gnathopod of a typical male collected from California; E, *C. acanthogaster*, second gnathopod of male after Vassilenko, 1974; F, *C. mutica*, second gnathopod of male after Vassilenko, 1974. Scale bars equal 1 mm except where otherwise noted.

2, and gnathopod 2 very setose; cephalon and pereonite 1 smooth dorsally; pereonite 2 with 1 pair of small spines dorsally. The ventral spines on pereonites 3 and 4 are less prominent than the dorsal spines on those pereonites, and the gills are oval, not long and slender.

Arimoto (1976) has described and illustrated both *Caprella mutica* and *C. acanthogaster* s.s. The description and figures he included for *C. mutica* are, for the most part, from Schurin (1935), and the material Arimoto examined was limited to one immature male. Therefore, Arimoto's information on *C. mutica* is of little use in the further diagnosis of *C. mutica* and *C. acanthogaster*. The description and figures of *C. acanthogaster* contained in Arimoto (1976) are more useful, since many specimens were examined, and since the figures provided depict mature specimens of various sizes from several localities. Arimoto (1976) describes the second pereonites of male *C. acanthogaster* as being setose distally, and the second gnathopod as sometimes being setose. He also states that the cephalon bears a pair of small spines, that pereonite 1 is smooth dorsally, and that pereonite 2 bears 4 pairs of spines dorsally.

Mayer (1903) describes *Caprella acanthogaster* males as having pereonite 2 and gnathopod 2 setose, and further states that pereonite 1 is smooth dorsally, but that pereonite 2 occasionally has a tubercle dorsally. Mayer's description is interesting, since he identified the syntype of *C. acanthogaster* in the Hamburg Museum.

I have not been able to locate type-material or specimens of *Caprella mutica*, but in comparing the available descriptions and figures of *C. mutica* with descriptions, figures, and specimens of *C. acanthogaster* and *C. acanthogaster humboldtiensis*, I discovered another difference in species character states. The second gnathopods of *C. acanthogaster* and *C. mutica*, although similar, show distinct differences. That of the *C. acanthogaster* syntype has an extremely large tubercle bearing the poison spine. The tubercle which bears the poison spine on the specimens collected in the present study and on those collected by Martin (1977), although large (especially in more mature males), is not nearly as large in comparison to the size of the propodus as is that of *C. acanthogaster* (Fig. 1D). This observation is supported by Vassilenko's (1974) figures, which indicate the differences between the second gnathopods of *C. acanthogaster* and *C. mutica* males (Figs. 1E and 1F), and also by Arimoto's (1976) figures. Vassilenko (1974) and Arimoto (1976) also figure the long, slender gills of *C. acanthogaster* which were noted on the syntype.

The foregoing descriptions and observations lead to the following conclusions: the specimens collected in Humboldt Bay, San Francisco Bay, and Elkhorn Slough are identical in appearance to those collected by Martin

(1977) in Humboldt Bay; that these specimens are specimens of *Caprella mutica*, and therefore that *C. acanthogaster humboldtiensis* Martin, 1977 is a junior subjective synonym of *C. mutica* Schurin, 1935. It is also apparent that, although similar in appearance, *C. mutica* and *C. acanthogaster* s.s. are distinct species, and Vassilenko (1974) separated them correctly on the basis of anterior setation, ventral spination, gnathopod morphology, and gill morphology outlined herein. Arimoto's (1976) descriptions seem to contradict somewhat the diagnosis of Vassilenko (1974). Arimoto has described *C. acanthogaster* as sometimes being setose anteriorly, and in his Fig. 91 has depicted both a setose male, and a non-setose male. The setose male also has a dorsally smooth pereonite 2, and possesses gills which are much shorter and more oval than those of the similarly sized non-setose male. Additionally, the second gnathopods of the males figured by Arimoto (1976) are somewhat different, with the second gnathopod of the non-setose specimen appearing very much like that on the syntype of *C. acanthogaster*. Not having seen Arimoto's specimens, one cannot make a definite judgment, but the illustrations seem to indicate that Arimoto (1976) described and illustrated *C. acanthogaster* from a mixed lot of *C. acanthogaster* and *C. mutica*.

The presence of dorsal spines on the first pereonite in *Caprella acanthogaster* is probably significant, even though they are not always present; however, I believe that the dorsal spines on the second pereonite are less reliable. It appears that pereonite 2 always has at least 1 pair of dorsal spines in *C. acanthogaster*, and that pereonite 2 in *C. mutica* is smooth dorsally, although occasionally possessing 1 pair of small dorsal spines (possibly only in larger specimens). Laubitz (1970) has noted that body spination is often variable, and that more thorough studies should include examinations of the mouthparts, therefore I plan to compare the mouthpart morphologies of *C. mutica* and *C. acanthogaster* as well as further examine other characters in a future study.

Remarks.—Martin (1977) has reported the introduction of this species (as *Caprella acanthogaster humboldtiensis*) into California, probably from Japan, and Carlton (1979) has noted its presence in San Francisco Bay. Carlton (1979) uses the name *C. acanthogaster* for this species, but since he is referring to *C. acanthogaster humboldtiensis* of Martin (1977), this *C. acanthogaster* is synonymous with *C. mutica*. I have not seen specimens of *C. acanthogaster* s.s. in San Francisco Bay.

The collections made for the present study extend the known range of *Caprella mutica* in California southward to Monterey Bay. Its total range at present includes the Sea of Japan (McCain and Steinberg, 1970; Arimoto, 1976), Humboldt Bay (Martin, 1977), San Francisco Bay (Carlton, 1979), and Monterey Bay, California.

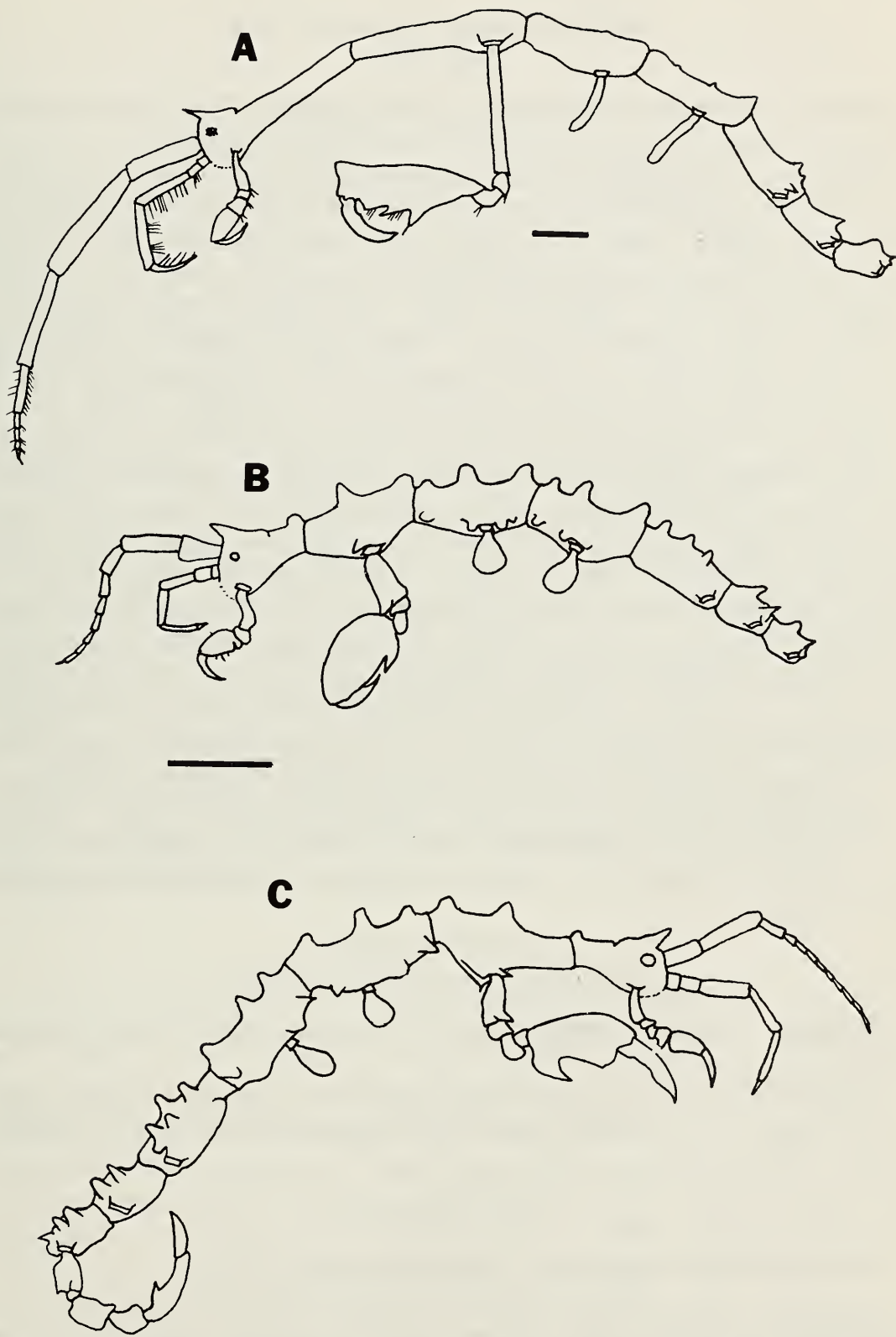


Fig. 2. A, *Caprella scaura*, lateral view of typical male from California; B, *C. verrucosa*, lateral view of a typical specimen after Laubitz, 1970; C, *C. verrucosa*, lateral view of a specimen with a ventral spine after Mayer, 1903. Scale bars equal 1 mm.

Caprella scaura Templeton, 1836

Fig. 2A

Material examined.—Approximately 25 specimens from San Francisco Bay, and approximately 10 specimens from Elkhorn Slough.

Discussion.—Specimens of this species were compared with 4 specimens of *Caprella scaura* from the British Museum, and with descriptions and figures in McCain (1968), Vassilenko (1974), and Arimoto (1980). In addition, Diana Laubitz examined specimens from San Francisco Bay, and confirmed that they were indeed *C. scaura*. This species closely resembles a common central California species, *C. californica*, but differs in the absence of a ventral spine between the insertions of the second gnathopods, and the possession of 2 pairs of short dorsal tubercles on pereonite 5 (Fig. 2A).

Remarks.—The collection of *Caprella scaura* in San Francisco Bay and Elkhorn Slough represents a new California and North American record for the species. It has previously been reported from: St. Croix and St. Barthélemy, Virgin Islands; Cocos Island, Costa Rica; Mayaguez, Puerto Rico; Ilha Sao Sebastiano, Santa Catarina, Victoria, Rio de Janeiro and 28°S, Brazil; Mjillones, Chile; Cumberland Bay, Isla Mas a Tierra, Juan Fernandez Isles; Hoshu, Kyushu and the Inland Sea, Japan; Vladivostok; Sydney and Kangaroo Island, Australia; Riviere Noire, Mauritius; and South Africa (McCain and Steinberg, 1970). It is not known if this new record represents an introduction to California, since *C. scaura* may be easily confused with *C. californica*, but the possibility of an introduction cannot be ruled out.

The specimens of *Caprella scaura* collected during this study resemble *C. scaura typica* of Arimoto (1980). However, McCain (1968) lists *C. scaura* var. *typica* as a variety of *C. scaura* s.s., and I have followed his designation in this paper.

Caprella alaskana Mayer, 1903

Material examined.—Approximately 10 specimens from San Francisco Bay.

Discussion.—This species is characterized by extremely variable spination (Laubitz, 1970; Martin, 1977), and immature stages can be confused with *C. ferrea*. However in the adult stage *C. alaskana* is much more slender than *C. ferrea*, and *C. ferrea* bears a pair of small tubercles on the cephalon (Laubitz, 1970). If dorsal tubercles are present on *C. alaskana*, the tubercle on the cephalon is unpaired (Laubitz, 1970).

Remarks.—The collection of *Caprella alaskana* in San Francisco Bay represents a southern range extension for this species, previously known from the Aleutian Islands to Trinidad Bay, California (Laubitz, 1970; Martin, 1977).

Caprella verrucosa Boeck, 1871

Fig. 2B, C

Material examined.—Approximately 25 specimens from San Francisco Bay, and 10 specimens from Elkhorn Slough.

Discussion.—*Caprella verrucosa* is a very distinctive species, bearing a triangular cephalic projection and large dorsal tuberculations on all pereonites (Fig. 2B). This species generally does not possess a ventral spine between the insertions of the second gnathopods, but many specimens from San Francisco Bay and Elkhorn Slough were found to have such a spine. This condition has not been previously reported, although Mayer (1903:Fig 2C) figured a specimen which appears to have a ventral spine, and the syntype in the collection of the California Academy of Sciences (CASIZ type-series # TY 00156 syntype male) also possesses such a spine. Laubitz (personal communication) has noted the presence of a ventral spine on specimens of *C. verrucosa* from the Friday Harbor, Washington area, and states that the spine seems to be present on specimens from protected waters. It is my observation that the size of the spine decreases with increasing body size. It is not known whether the spined form is an ecotype or an ecophenotype, and therefore the term morphological variant is used here. Further study will be necessary in order to determine whether the observed variation is genetic or is a result of environmental expression.

Remarks.—The presence of a ventral spine on *Caprella verrucosa* seems to have little significance, except that in current taxonomic keys (e.g., Laubitz, 1970; McCain, 1975; Martin, 1977) the presence of this character may cause an individual not familiar with the Caprellidae to make an erroneous species determination.

Acknowledgments

I wish to thank Diana Laubitz of the National Museums of Canada for her kind assistance with some of the species determinations. I would also like to thank Jon D. Standing for his invaluable suggestions, and Dustin Chivers of the California Academy of Sciences who provided access to collections and offered many helpful recommendations.

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